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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/777,120	02/05/2001	Arie E. Kaufman	AP30612-C-072600.0171	2426
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BAKER & BOTTS 30 ROCKEFELLER PLAZA NEW YORK, NY 10112			EXAMINER AZARIAN, SEYED H	
			ART UNIT 2625	PAPER NUMBER

DATE MAILED: 11/04/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/777,120

Applicant(s)

KAUFMAN ET AL.

Examiner

Seyed Azarian

Art Unit

2625

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 July 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 51-59 and 62-72 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 51-59 and 62-72 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 May 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

RESPONSE TO AMENDMENT

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 7/26/2004 has been entered.

1. Applicant's amendment filed, 7/26/2004, has been entered and made of record.
2. Applicant's arguments with regards to claims 51-59 and 62-72 have been fully considered but they are not persuasive in view of the new grounds of rejection necessitated by applicant's amendment.

Contrary to the applicant's assertion, Vining discloses a system: a characteristic indicating abnormal wall structure is affected by determining a normal vertex for each vertex position of wire frame model. A wall thickness value associated with each normal vector is determined for each vertex. Local convexity and curvature are also determined on a per vertex basis, then contiguous vertices having a characteristic indicating abnormal thicknesses or other abnormal properties (column 2, lines 31-54), also Fig. 5, the convexity is a measure of the direction and magnitude of the shape of the surface of the population, when the structure is a colon populations with a negative convexity value are excluded from being considered abnormal. Further, only

populations having a positive convexity value above a minimum value are reasonably expected to be potential lesions (abnormal texture), since cancerous colon masses are generally manifested by steeply sloped growths, also the higher the magnitude of the convexity value, the greater the slope of the surface of the population (column 11, line 51 through column 12, line 17).

In response to applicant's argument, essence that there is no teaching to "3D, voxel based representation of a region of interest", as indicated by Vining, teaches the following features: the two dimensional images are arranged in computer memory to create a three-dimensional data volume, to create isocubic volume elements (voxels), (column 5, lines 29-39).

Finally, in response to applicant's arguments that there is no teaching to "cumulating distribution as thinning density". Additionally, Vining discloses the wall thickness values, local convexity values, and local curvature values can be used, independently or in conjunction (cumulating) with each other (column 10, lines 56-65).

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 51, 59, 62 and 70-72, are rejected under 35 U.S.C. 102(b) as being anticipated by Vining et al (U.S. patent 5,920,319).

Regarding claim 51, Vining et al discloses a method of performing computed assisted diagnosis of a region of interest, comprising (Fig. 1, column 5, lines 3-11, region of interest);

acquiring imaging scan data including at least a portion of the region of interest (column 2, lines 55-66, images acquired by scanner to select region of interest);

converting the imaging scan data to a volume representation including a plurality of voxels, at least a portion of the voxels representing a surface of the region of interest, analyzing said portion of voxels representing a surface to determine a context surface texture feature of the region of interest (column 6, lines 24-35, the voxels or volume of the segment region of interest are tagged and column 10, lines 56-65, identifies abnormal thickness and curvature);

analyzing said portion of voxels representing a surface to identify a local surface texture feature, different from the context texture feature, which is indicative of an abnormality (column 2, lines 31-54, a characteristic indicating abnormal wall structure is effected by determining a normal vertex for each vertex position of wire frame model. A wall thickness value associated with each normal vector is determined for each vertex. Local convexity and curvature are also determined on a per vertex basis, then contiguous vertices having a characteristic indicating abnormal thicknesses or other abnormal properties, also column 11, line 51 through column 12, line 17, Fig. 5, the convexity is a measure of the direction and magnitude of the shape of the surface of the

population, when the structure is a colon populations with a negative convexity value are excluded from being considered abnormal. Further, only populations having a positive convexity value above a minimum value are reasonably expected to be potential lesions (abnormal texture), since cancerous colon masses are generally manifested by steeply sloped growths, also the higher the magnitude of the convexity value, the greater the slope of the surface of the population).

Regarding claim 59, Vining et al discloses the method of performing computer assisted diagnosis, wherein the region of interest includes the aorta and wherein the abnormality includes abdominal aortic aneurysms (column 3, lines 53-64, refer to blood vessels and airway).

Regarding claim 62, Vining et al discloses a method of performing computed assisted diagnosis of a region of interest, comprising (Fig. 1, column 5, lines 3-11);

acquiring imaging scan data including at least a portion of the region of interest (column 2, lines 55-66, images acquired by scanner to select region of interest);

converting the imaging scan data to a volume representation including a plurality of voxels, at least a portion of the voxels representing a surface of the region of interest (column 6, lines 24-35, the voxels or volume of the segment region of interest are tagged, also column 10, lines 56-65, identifies abnormal thickness and curvature);

analyzing said portion of voxel representing a surface for both a geometric feature and a local surface texture feature indicative of an abnormality (Fig. 5, column 11, line 51 through column 12, line 17, the convexity is a measure of the direction and magnitude of the shape of the surface of the population, when the structure is a colon

populations with a negative convexity value are excluded from being considered abnormal (geometric feature), further, only populations having a positive convexity value above a minimum value are reasonably expected to be potential lesions (abnormal texture), since cancerous colon masses are generally manifested by steeply sloped growths, also the higher the magnitude of the convexity value, the greater the slope of the surface of the population), further (column 5, lines 29-39 two dimensional images are arranged in computer memory to create a three-dimensional data volume, to create isocubic volume elements (voxels)).

Regarding claim 71, Vining et al discloses the method of performing computer assisted diagnosis according to claim 62, wherein the surface is represented as a second differentiable surface where each surface volume unit has an associate Gauss curvature and wherein said Gauss curvatures combine to form said geometric features (column 10, lines 48-55, area of curvature).

Regarding claim 72, Vining et al discloses the method of performing computer assisted diagnosis according to claim 62, wherein a plurality of predetermined geometrical feature templates are defined and wherein the geometric features of said surface are compared to said templates to determine a geometric feature classification (column 14, lines comparing the conventional method by storing surface points (voxels) on the outer surface of the region-grown object).

Regarding claim 70, recite similar limitation as claim 59 are similarly analyzed.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 52-58 and 63-69, are rejected under 35 U.S.C. 103(a) as being unpatentable over Vining et al (U.S. patent 5,920,319) in view of Greensite (U.S. patent 4,991,092).

Regarding claim 52, Vining fails to disclose, "probability density function characterizing between two voxels". On the other hand Greensite in the same field of medical imaging teaches the distance between two voxels dependent on the difference in probability, the probability density of random vector at each point of the signal space (column 15, lines 36-62).

Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention was made, to modify Vining et al invention according to the teaching of Greensite because it provides a tone value to each of the plurality of voxels corresponding to the value of the density function for each of the voxels and displaying each voxel represented by a pixel with assigned tone value, which can easily be implemented in an image device such as X-ray or CT device.

Regarding claim 53, Vining et al discloses the method of performing computed assisted diagnosis, wherein the two voxels are adjacent voxels (Fig. 10e, column 15, lines 22-37, polygon adjacent).

Regarding claim 54, Vining et al discloses the method of performing computer assisted diagnosis according to claim 52, wherein intensities of said portion of voxels are used to generate an estimate of the probability density function (column 6, lines 28-40, an intensity profile along each vertex's normal vector is calculated to measure x-ray attenuations factor and into the surrounding tissue until the voxels value).

Regarding claim 55, Vining et al discloses the method of performing computer-assisted diagnosis, according to claim 54, wherein a plurality of voxel intensities are used to generate a cumulating distribution function of the region of interest and a local cumulating distribution function, and wherein the local cumulating distribution function is compared against the context cumulating distribution function to identify regions of abnormality (column 10, lines 56-65, the wall thickness values, local convexity values, and local curvature values can be used, independently or in conjunction (cumulating) with each other).

Regarding claim 57, Vining et al discloses the method of performing computer assisted diagnosis, wherein the distance is used to assign intensity values to the voxels representing a surface of the region of interest and wherein said method further comprises displaying said voxels such that variations in intensity represent regions of abnormality (column 6, lines 33-40, an intensity profile along each normal vector is

calculated, into the surrounding tissue until the voxel values begin to decrease or increase).

Regarding claim 58, Vining et al discloses the method of performing computer-assisted diagnosis, wherein the region of interest includes the colon and wherein the abnormality includes polyps (column 7, lines 10-27, refer to grow an object or polyps).

Regarding claims 56 and 63-65, recite similar limitation as claims 51-54 are similarly analyzed.

Regarding claims 66-69, recite similar limitation as claims 55-58 are similarly analyzed.

Other prior art cited

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. patent (5,458,111) to Coin is cited for computed tomographic colonoscopy.

U.S. patent (5,361,763) to Kao et al is cited for method for segmenting features in an image.

U.S. patent (5,101,475) to Kaufman et al is cited for method and apparatus for generating arbitrary projections of three-dimensional voxel-based data.

U.S. patent (5,095,521) to Troussel et al is cited method for the computing and imaging of view of an object.

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Contact Information

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Seyed Azarian whose telephone number is (703) 306-5907. The examiner can normally be reached on Monday through Thursday from 6:00 a.m. to 7:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta, can be reached at (703) 308-5246. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application information Retrieval (PAIR) system. Status information for published application may be obtained from either Private PAIR or Public PAIR.


Status information about the PAIR system, see [http:// pair-direct.uspto.gov](http://pair-direct.uspto.gov). Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Seyed Azarian

Patent Examiner

Group Art Unit 2625

October 20, 2004



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